UNIVERSITY OF WASHINGTON

ARBORETUM BULLETIN

Published Quarterly by the Arboretum Foundation

WINTER 1972

PRESIDENT'S MESSAGE

In my message to you in the fall, 1972, *Bulletin,* I reported on some of the problems regarding the future management of the Arboretum, specifically the negotiation of a lease by the University. The original agreement between the city and the University was just exactly that--an agreement of use and not a lease. It is quite understandable that the University would want a long-term legal indication of security before they could proceed with either buildings or program.

At the Legislative Budget Committee hearing in Bellingham, October 27, 1972, there appeared to be agreement between the mayor's office and the University as to the nature of such a lease; however, following an exchange of letters between Dr. Odegaard's office and that of the mayor, it again seemed that there were some unresolved areas.

On December 13, Councilman Bruce Chapman held a hearing in the council chambers wherein parties interested in the future of the Arboretum were invited to testify before members of the council and the Seattle Park Board. Mr. Phil Johnson represented the Arboretum Foundation, and Elizabeth Moses represented the Unit Council. Other members of the Foundation spoke for themselves as concerned individuals. The Foundation was well represented and its position described exceedingly well. We wish to thank all those who participated. The December meeting did not provide a resolution, and for that matter was not expected to, but simply gave the Council and Park Board a chance to hear varying points of view. Since that meeting, Councilman Chapman and Mayor Uhlman have called a committee of representatives from the University, the city, and other concerned groups including the Foundation, under the chairmanship of Mr. Calhoun Dickinson, presently Chairman of the Park Board. The committee is a small group, meeting face to face to discuss the matter further in order to ultimately make

(Continued on p. 33)

THE ARBORETUM BULLETIN

Vol. XXXV No. 4
Seattle, Wa., Winter 1972

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The ARBORETUM BULLETIN is a journal of general horticultural information published quarterly, as a bonus of membership, by the University of Washington ARBORETUM FOUNDATION, a non-profit organization to further the development of the University of Washington Arboretum. Information regarding membership in the Foundation may be obtained by writing to the ARBORETUM FOUNDATION, University of Washington, 98195 or by calling EA 5-4510. Articles on botany and horticulturally related subjects written by professional and amatuer botanists, horticulturists, educators and gardeners are welcomed. *No part of this BULLETIN may be reprinted without the authority of the ARBORETUM FOUNDATION.*

THE UNIVERSITY OF WASHINGTON

Arboretum bulletin

VOLUME XXXV, NUMBER 4

Winter, 1972

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COVER PHOTO: *Cornus nuttallii* in winter.
Photo by: B.O. Mulligan

Adiantum pedatum var. *aleuticum* by trail to Stuart Pass, Chelan Co , Wash. Alt. about 5,000-5,200 ft. Plants 12 ins. tall, at 8 ft. distance. Note *Polystichum mohrioides* at right center of group.

Photo by: B. O. Mulligan

Ferns of the Pacific Northwest: Their Cultivation and Propagation

*T. M. C. TAYLOR**

Those of us who are privileged to garden in the coastal regions of the Pacific Northwest appreciate Nature's bounty to us. The general mildness of our climate, the adequacy of our rainfall and the great variety of our soils make possible the cultivation of a remarkable range of plants. Gardeners are strange folk, though, as any plant that comes from a distance, particularly from overseas, is greatly prized while natives are almost invariably ignored. The majority of our native ferns are frequently dismissed as having little garden merit or as being hard to grow, or difficult to propagate, or we are just ignorant of their existence. It is hoped that the following notes will help to raise this group of ancient plants in the esteem of gardeners and so encourage their use in landscape and garden plantings.

Most gardeners in the northwest are well aware of rhododendrons; their range of size and appearance; their different habits of growth; their individual tolerances of light and shade; their general preference for well drained loamy

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*Dr. Taylor, Professor Emeritus of Botany, University of British Columbia, is the author of *Pacific Northwest Ferns and their Allies;* Univ. of Toronto Press, Toronto, 1970; and *The Ferns and Fern Allies of British Columbia;* B.C. Provincial Museum, Victoria, Handbook No. 12, 1956, repr. 1971.

soil laced with humus, etc. In these respects ferns (of many genera and species) are the counterparts of the many species of the single genus *Rhododendron*. In detail it is likely that each kind of fern has its own particular environmental needs. In practice, however, they are found to be surprisingly tolerant of variations in this respect provided that certain minimal conditions are met. This remark is made not with the thought of encouraging growers to ignore the optimum conditions for the various species but rather to remove the view that they are difficult to grow.

Ferns, in general, may be grouped in a variety of ways: there are those that have short vertical stems, those that have widely spreading underground stems, and those that fall somewhere between these extremes; there are those that are deciduous, losing their leaves in the fall and those that are wintergreen, although some of the latter may lose their leaves during the summer or when dry conditions prevail; some definitely prefer lime or magnesium in their soil while others grow best in acid soils; some are sun-loving, others are adapted to varying degrees of shade; some tolerate periods of extreme dryness, others require plenty of moisture; some are large dominating plants while others have fronds only a few inches long. These groupings are mentioned not only to draw attention to the great variety of ferns but also to emphasize the fact that if ferns are going to be included in the garden there are many characteristics that should be kept in mind before placing them in the ground.

The casual gardener who would like to grow some ferns need not read further. The rule for success is to study the conditions under which the plant is growing and then as far as possible try to provide them in the garden. The notes that follow are for those who would like to make a reasonably complete collection of the species in our area. Identifying descriptions are not given as these are available in a number of works dealing with our plants. These are listed at the end of this article. Emphasis is placed on the characteristics mentioned above. The list of species is not exhaustive as it only includes the commoner ones of the region. For convenience they are listed alphabetically under their scientific names.

Adiantum pedatum. Maidenhair fern. Fronds deciduous, up to 2 feet or more long, scattered; underground stem rather wide-creeping and branched; plants of moist, shaded slopes with seepage important during the summer; excellent for the woodland garden.

Aspidotis densum. Oregon Cliff-brake, Indian's dream. Fronds wintergreen, erect, up to 12 inches long, delicate and feathery; underground stem somewhat horizontal, branched but compact so the fronds are in tufts; found on exposed talus slopes, crevices and ledges of calcareous or serpentine rocks; appears difficult to maintain in the rockery but very attractive while it lasts.

Asplenium trichomanes. Maidenhair spleenwort. Fronds evergreen, spreading, up to 8 inches long, in rosettes or tufts; stems short, erect; found in shaded crevices, rocky ledges or talus slopes; very good for a shaded rockery, will tolerate some dryness in the summer.

Asplenium viride. Green spleenwort. Fronds evergreen, delicate, erect, 6 inches or less in length; stem short, vertical, much branched so that the fronds are in tufts; an alpine or high montane species of limestone crevices or fine talus in rather full shade; excellent for crevices in the rockery where it can be kept moist in summer.

Asplenium viride **on a rocky bank, upper Yoho river valley, B.C., Canada.**

Photo by: B. O. Mulligan

Athyrium distentifolium. Alpine ladyfern. Fronds early deciduous, erect, up to 2 feet or more in length; stem vertical but tending to form new crowns so developing into clumps; grows in alpine or high montane regions in rocky or peaty soil in the open; can be grown in full sun if kept moist and not allowed to dry out.

Athyrium filix-femina. Ladyfern. Fronds deciduous, erect to arching, up to 5 feet long; stem more or less vertical producing fronds in vase-like arrangement; very common in low ground and shady places generally; easily grown and even apt to be weedy.

Blechnum spicant. Deer fern, Hard fern. Vegetative fronds wintergreen in a rosette flat on the ground, as much as 18 inches long, fertile fronds deciduous, slender, erect, 2 feet or more tall; stem short-creeping so forming clumps; found in damp shady woods and roadsides; very handsome if grown in damp, rich soil with lots of humus.

Cheilanthes gracillima. Lace fern. Evergreen with delicate tufted fronds up to 8 inches long; stems erect, much branched; strictly a rock loving species growing in crevices or on ledges of igneous rocks, indifferent as to shade and will tolerate short periods of summer dryness; a good rockgarden species.

Cryptogramma crispa. Parsley fern. Fronds dimorphic, the vegetative wintergreen, short and spreading, the fertile deciduous, erect to 8 inches long; stem vertical, branched to form tight clumps; grows best in the sun in crevices, rock ledges or talus, will tolerate a good deal of summer dryness; an excellent rockery species.

Cystopteris fragilis. Bladder fern, Fragile fern. Fronds deciduous in autumn but also if exposed to drouth at any time during the growing season, up to a foot or more in length, delicate; stem short-creeping; common almost everywhere in damp well drained situations, either in shade or sun and apparently not particular as to its soil; very adaptable to cultivation.

Dryopteris arguta. Coast Wood fern. Fronds wintergreen, rather harsh, erect, up to 2 feet or more long; underground stem rather stout, branched and spreading so eventually forming large colonies; usually found in rather deep, well drained mineral soil in part shade; a handsome garden fern with its dark green, wintergreen fronds, can become somewhat invasive.

Dryopteris austriaca. Spiny Wood fern. Fronds more or less deciduous turning yellowish-green in autumn, somewhat spreading in a vase-like arrangement, up to nearly 3 feet in length; stem pretty much erect, occasionally branching to produce secondary crowns; common in wet woods and roadsides where the soil is high in humus, requires considerable shade and moisture; an excellent species for the woodland garden.

Dryopteris filix-mas. Male fern. Fronds deciduous, erect, up to 2½ feet long; stem erect, in time branching to form several crowns; found in open woods and thickets, rocky hillsides where there is seepage, mostly in part shade; good garden subject, forming large clumps in time.

Gymnocarpium dryopteris. Oak fern. Fronds deciduous, very delicate, mostly about 1 foot long; underground stem widely spreading and branched so that the fronds are well separated; grows best in damp soil rich in humus in considerable shade; when once established this species makes a good groundcover in the fern garden, care must be taken to avoid it drying out.

Pityrogramma triangularis. Goldback fern. Fronds more or less wintergreen, rolling up during the heat of a dry summer, usually a foot or less in length; underground stem somewhat spreading so that the fronds tend to be in lines; found with us as a coastal species in crevices and on ledges of sea cliffs where it will be well baked in summer; a very handsome fern but difficult to establish, the summer baking being very important.

Polypodium glycyrrhiza. Licorice fern. Fronds wintergreen, produced from August to February dying down during the summer, usually about 12 inches long, scattered; underground stem rather thick, spreading and branched; a coastal species for the most part, found in a variety of habitats, often on mossy rocks in at least part shade; easily grown and welcome for its

Athyrium distentifolium **beside a melting snow bank, Perry Creek Valley, Snohomish Co., Wash. Height 20 ins.**

Photo by: B. O. Mulligan

habit of putting up new, bright green fronds during the autumn.

Polypodium hesperium. Western Polypody. Fronds wintergreen, produced during the summer months, less than 8 inches long; underground stem creeping and branched so fronds are scattered; an interior species that rarely reaches the coast, found growing on rocks and in crevices in part shade; a useful rockery species easily established.

Polypodium scouleri. Scouler's Polypody, Leather fern. Fronds thick and leathery, wintergreen, somewhat coarse, up to 12 inches long; underground stem thick, spreading and branched; strictly a coastal species of sea cliffs or as an epiphyte on Sitka spruce; will do best in half shade with a plentiful supply of moisture; also makes a good houseplant if kept reasonably cool.

Polystichum andersonii. Anderson's Sword fern. Fronds more or less wintergreen with one or two bulblets at the tips, erect, to as much as 3 feet in length, in a handsome vase-like arrangement; stem thick, erect, rarely forming secondary crowns; grows in half shade in rocky woods in well drained, damp soil; excellent for the garden but should be planted in a protected spot to avoid wind damage to its tall fronds.

Polystichum lonchitis. Holly fern. Fronds wintergreen, up to 2 feet long, spreading or more or less appressed to the ground, often in a rosette; stem erect, rarely branching; a montane species of rocky woods and shaded talus, does best in gritty, well drained soil, should not be allowed to dry out.

Polystichum mohrioides. Shasta Shield fern. Fronds wintergreen, tufted, erect, up to 15 inches long; stem erect, freely branched; plants of open, rocky hillsides, probably limited to serpentine areas; good for the rockery, will do best with the addition of lime to the soil although this does not seem to be essential for survival, should be given half shade unless plenty of water is available.

Polystichum munitum. Sword fern. Fronds wintergreen, erect to arching, as much as 4-5 feet long under good growing conditions; stem erect, thick, sometimes branched to form secondary crowns; a large fern of quite dense shade and wet, though well drained soil; excellent for the garden where its size is in scale; a small form that grows on exposed rocky ledges in full sun is a good rockery plant.

Polystichum scopulinum. Eaton's Shield fern. Fronds wintergreen, tufted, erect, up to 2 feet long; stem erect, rather freely branched but remaining compact; a montane species growing in well drained soil on rocky hillsides usually in more or less full sun; can be grown in ordinary woodsy soil or in the rockery.

Pteridium aguilinum. Bracken. Only included here to warn those who are not familiar with its invasive ways that it should never be introduced into the garden; in time it can be eliminated with the breaking off of each frond as it appears, it may take several years but there is encouragement in the fronds getting smaller each year!

Thelypteris nevadensis. Sierra Water fern. Fronds deciduous, erect, as much as 2 feet long, often less; underground stem horizontal, freely branching so producing fronds in rows and developing large clumps; grows in damp woods and streamsides in part shade; easily established and very attractive throughout its short growing season, it is late appearing in the spring and usually the first to turn brown in the fall.

Thelypteris phegopteris. Northern Beech fern. Fronds rather delicate, deciduous, spreading, 18 inches or less in length; underground stem very widely creeping and branched so that the fronds are separated; a plant of crevices and moist rocky banks usually under trees, will make a good ground-cover when well established in a shady corner with lots of humus and adequate moisture.

Woodsia oregana. Oregon Woodsia. Fronds deciduous, erect, usually not more than 8 inches in length; stem short, erect, much branched so that fronds are produced in tufts; found on rock ledges and talus slopes commonly in full sun; tolerates considerable dryness, may lose its fronds during summer dryness putting up new ones with the return of moisture; a

Polystichum munitum **forma** *imbricans,* **growing near north end of Lake Chelan, Wash.**

Photo by: B. O. Mulligan

rockery species that requires well drained, gritty soil in full sun.

Woodsia scopulina. Rocky Mountain Woodsia. Similar to the Oregon Woodsia but usually larger and coarser; grows under the same conditions and requires the same garden treatment.

Woodwardia fimbriata. Chain fern. Fronds winter-green, large and somewhat coarse, erect or nearly so, may be as much as 5 feet long; stem thick, erect, sometimes branched to produce secondary crowns; occurs in low places in damp woods and along streamsides; perhaps the most outstanding of our native ferns, its responds very well to cultivation in good garden soil in part shade, it should be sited with its ultimate size in mind.

Ferns may be propagated vegetatively or by means of spores. Vegetative propagation is easily accomplished by division of a mother plant, preferably in the autumn or early spring. Secondary crowns may be removed by a vertical cut with a sharp knife; clumps may be similarly divided. Those species that have spreading and branched underground stems may also be divided; care should be taken in these cases that the portion removed includes the tip of the stem where a new frond will grow. Anderson's sword fern is unique with us in having one or two bulblets toward the tip of each frond. In this case, fronds should be pinned down in the spring so that the bulblets are in contact with the soil. Do not remove the frond from the mother plant and do not cut off the developing bulblet until its own root system is well established. In all cases it is good practice to pot up the divided portions so that they can be given special attention during their first year of independent growth.

Growing ferns from spores presents quite a challenge but is not too difficult if the essentials are understood. Spores are not seeds, rather they grow into the sexual generation of the fern. The sexual generation known as the gametophyte (or prothallus) produces the sex organs that give rise to the eggs and sperms. The eggs are retained within the gametophyte but the sperms are discharged and being motile swim to the egg and fertilize it. As a result of this fertilization a new fern is produced that in time will grow to its adult size and appearance. In nature, the small, heart-shaped gametophytes are sometimes found in damp shady places near mother plants. There are two requisites for their successful development. These are a moist atmosphere as the gametophytes dry out very easily, and liquid moisture at the time the sperms are mature so that they can swim to the eggs. When we raise ferns from spores under artificial conditions both these requisites have to be met; this can be done in a variety of ways. The following is a simple basic method.

Spores are obtained by placing a mature fertile frond, one that has obvious spore cases on the back, back downward on a sheet of paper in a dry atmosphere. The spores will soon be shed appearing as a dark dust on the paper. They can be packaged and stored in a cool, dry place until required, most will retain their viability for several weeks.

When ready to sow the spores, small containers should be prepared. Clear plastic boxes with lids used for regrigerator dishes are excellent for this purpose. Fill them about half full with vermiculite or well washed, coarse sand and cover this to within half an inch of the top with finely sieved and sterilized wood soil or peat. Sterilization may be done by baking the soil in an oven for an hour at 250°. The reason for the sterilization is to reduce the chances of damping-off. The sterilized soil, while still hot, is put into the containers and wetted down with boiling water until the whole is just damp without a film of water on the surface. Put the lid on the containers and let them cool. When cool, dust the surface lightly with spores, replace the lid, keep at room temperature and ignore until a green appearance indicates that the spores have germinated.

The growth of the gametophytes can now be stimulated by exposure to increased hours of light, either natural or fluorescent. When the growth of the gametophytes into small, thin, heart-shaped structures is quite apparent the surface of the soil should be kept shiny wet, but not flooded, with water. Some add necessary water by means of an atomizer. The purpose of this film of water is to permit the movement of sperms to fertilize the eggs. After an egg has been feritilized, a tiny fern plant will make its appearnce growing up from the under side of the gametophyte — usually one to each gametophyte. These plantlets should be left undisturbed, except for being kept moist, perhaps for as long as six months, until they are

large enough to handle with a pair of forceps and can be pricked-off into small pots (or tin cans with drainage holes punched in the bottom). The pots should be filled with a sterilized mixture of equal parts of leafmold, good topsoil and sand or vermiculite. The plantlets will be very susceptible to drying out so it is wise to place them and their pots in a larger container under glass or plastic which can be removed gradually to allow the plants to harden-off. The plants should not be set out in the garden until they are obviously large enough to fend for themselves.

Every serious grower of ferns will find the *American Fern Journal*, a quarterly devoted to ferns to be an invaluable source of reliable and readable information on all aspects of the study of ferns. Other useful sources of information on the cultivation of ferns are 'The gardener's fern book' by F. Gordon Foster (Van Nostrand Co., 1964) and the 'Handbook on ferns' (Handbook No. 59, Brooklyn Botanic Garden, 1969). For descriptions and illustrations of species native to the Pacific Northwest the following may be consulted:

Frye, T.C. Ferns of the Northwest. Metropolitan Press, Portland, 1934.

Hitchcock, C.L. et al. Vascular Plants of the Pacific Northwest, Part 1. Univ. of Washington Press, Seattle. 1969.

Taylor, T.M.C. The Ferns and Fern Allies of British Columbia. B.C. Provincial Museum, Victoria. Handbook No. 12, 1956, repr. 1971.

_____. Pacific Northwest Ferns and their Allies. Univ. of Toronto Press, Toronto and Buffalo, 1970.

Polystichum munitum **unfurling in Spring.** Photo by: David Metheny

THE ROLE OF THE WASHINGTON PARK ARBORETUM IN PUBLIC AND COMMUNITY SERVICES*

Dale Cole, Director, Center for Ecosystem Studies, U of W
Joseph A. Witt, Assistant Director, U of W Arboretum
and
Steven G. Archie, Staff Forester, College of Forest Resources, U of W

INTRODUCTION

The Washington Park Arboretum is one of the foremost visual attractions of the City of Seattle. Situated on land owned by the City, the Arboretum has been brought to its present condition under a 1934 cooperative arrangement between the Seattle Park Board and the University of Washington. The University's development of the site has been aided immeasurably by the Arboretum's lay organizations and by other devoted groups and individuals. The resulting Arboretum is internationally recognized as containing one of the leading woody plant collections in the world.

Public service has been a major concern of the Arboretum since its beginnings. The scope of this service reflects a number of significant changes which have occured during the years since 1934. The population of the Greater Seattle area and the student enrollment at the University of Washington have quadrupled. The psychological impact and various problems associated with the metropolitan environment have assumed new shades and increased complexities. Citizen concern for the quality of environment and amenity value of open spaces have intensified.

Influenced in one way or another by these trends, an estimated half million persons are now attracted to the Washington Park Arboretum each year. This represents a great increase over earlier years, a situation largely due to the physical improvements and plantings which the University has provided to further its objectives of education, research, and public service. As a result of intensifed and often incompatible public uses, however, it has become increasingly difficult to manage the site as an arboretum.

The Arboretum's collection of woody plants provides a singular and beautiful ornament to the community. But it is the uses that are made of this collection — the programs which are supported by it — which distinguish the Arboretum as an institution. In the present circumstances, the Arboretum represents an unfulfilled potential, and only by significant changes can it effectively promote the public interest.

Because the 1934 arrangement with the City did not provide the University with adequate administrative control in the Arboretum, it has been continuously frustrated in its efforts to develop facilities and staffing there. Such programs as had been possible were severed or reduced by the Legislature's budget cuts in 1971. Even the routine maintenance of the grounds has since been inadequate, and is continuing only with temporary Federal funds provided by the Emergency Employment Act, due to expire in March.

The University submitted a detailed report of the Arboretum problems to the Legislative Budget Committee on July 10, 1972. The basic problems were shown to be that the distinctions and conflicts between "arboretum" activities and "park" pursuits have not been widely understood and the interpretations given to "arboretum" uses have been distorted by a number of divergent viewpoints.

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*This policy statement by the University of Washington uses the term *Washington Park Arboretum* to differentiate from other arboreta properties under its management.

WHAT IS THE ARBORETUM?

To better understand the nature of these conflicts, it is necessary to know what the Arboretum is and how as an institution it should relate to the public and the community. This may be clarified by reviewing the objectives of the Washington Park Arboretum as they were envisioned by the University in 1934. These were:

1. To form and maintain a living museum of the trees and shrubs native to the Pacific Northwest and especially to the Puget Sound region, and to develop the available area most advantageously, having due regard to the plants growing there and to the persons who will visit and use it;
2. To introduce new or rare woody plants from all possible sources; to propagate and distribute those considered potentially valuable, in any respect, to appropriate similar institutions, research or experiment stations, or to nurseries for wider dissemination;
3. To supply information on horticultural matters to groups and individuals through lectures, classes, demonstrations, publications, and use of the Arboretum Library;
4. To provide an outdoor study area for a number of departments and colleges of the University, especially the Colleges of Forest Resources, Architecture and Urban Planning, and the Departments of Botany, Zoology, and Art;
5. To cooperate in providing materials and facilities for research connected with woody plants.

Dr. George B. Richmond, in the July 1971 issue of *Arboretum and Botanical Garden Bulletin,* provides a general definition of an arboretum:

> "An *institution* which develops and administers collections of trees and shrubs, arranged in aesthetic harmony with the surrounding landscape, and which conducts programs based upon these collections for the purposes of public service, education, and research."

These three purposes of public service, education, and research are not mutually exclusive. Rather, in the activities of the University and its Arboretum, these functions have historically overlapped and strengthened each other. They have been integrated in a deliberate manner by the Arboretum staff, and as with any viable institution, their direction and scope have changed as time and circumstances were altered. Despite constraints of jurisdiction and funding, the Arboretum has contributed in a number of significant areas.

THE HISTORY OF THE ARBORETUM IN PUBLIC AND COMMUNITY SERVICE

Public service has long been the common thread which unites the spectrum of activities in the Washington Park Arboretum. While the early years were devoted to building the Arboretum literally from the ground up, records indicate that by 1937 certain services were being made available to the general public. These were in the form of radio programs done by various staff in conjunction with members of the Arboretum Foundation. The *Arboretum Bulletin* was used to publish gardening and horticultural information starting with the first issue in 1937. This general interest magazine is still published quarterly by the Arboretum Foundation.

During these early years, when there was very little woody plant material established on the grounds, the Arboretum developed trial beds for annuals and was an All American test garden for these colorful plants. Shortly after the end of the World War II a course in horticultural training for returning veterans was established in cooperation with Edison Technical School. This graduated a number of skilled gardeners before the program terminated about 1947.

By 1970 hundreds of letters and thousands of phone inquiries were being received annually. These queries cover a wide range of horticulturally related subjects, and indicate the need for expansion of the Arboretum's staff to better provide these services.

Many inquiries received by the Arboretum concern insect damage, diseases, and cultural problems of ornamental plants. In 1970, a "Plant Clinic" was set up on a trial basis to see if this service could be upgraded. Two graduate

students and two professors from the College of Forest Resources made several hours a week available to meet with any gardener who had a problem of this nature.

Public relation activities such as tours of the Arboretum and talks before garden clubs and service organizations have also increased in number. Public lectures and symposia have been part of the Arboretum's efforts as well. It has actively participated in programs given by the Friends of the Arboretum, the Arboretum Foundation and the College of Forest Resources. Recent examples are sponsoring of the 27th Congress of the American Horticultural Society in 1972, the Ericaceae exhibit for the Eleventh International Botanical Congress (1969) and the Symposium on "The Urban Arboretum in Time of Crisis" (1972). The general public has benefitted greatly from lectures sponsored by the Friends of the Arboretum and the Arboretum Foundation; these may attract as many as 200 persons.

In 1958 an adult continuing education program designed to offer short courses and demonstrations in all phases of ornamental horticulture, gardening, and related fields was activated. This program was highly successful and the majority of classes were full. When the "Clubhouse" burned in 1968 finding other convenient facilities became difficult. The number of courses offered were reduced to those which could be held in the greenhouses or on the grounds. A total of 613 persons attended 26 courses in 1971 and 1972, and many people had to be turned away.

At the present time, thousands of Seattle-area school children visit the Arboretum annually with their teachers. In order to provide a more meaningful experience for these visitors, a short self-guiding nature trail primarily of native plants was established in 1957. The scope of this program was enlarged in 1961 when the Arboretum Foundation began training volunteer guides to conduct tours of both the native plant walk and the Japanese Garden.

In the past decade, especially since the public has become aware of environmental issues, the Arboretum staff has been called on to give advice to various state and municipal agencies on the selection and planting of woody plants. The Director, Assistant Director and nursery foreman have, for instance, discussed and advised on such topics as the correct selection of street trees, proper planting and pruning techniques for public plantings, preparation of street tree ordinances, and the reasons that certain plants fail in certain sites. The Arboretum and the State Highway Department cooperate in small scale trials of new plants for highway landscaping, although such activities have been minor in scope due to lack of staff.

As mentioned previously an integral part of the Arboretum's horticultural endeavors is its plant introduction program. Through an international network of affiliated institutions, material is obtained from other regions. Acclimatization tests determine the adaptability of plant varieties to the Pacific Northwest environment and determine their utility for ornamental and other practical purposes.

As the Washington Park Arboretum collection grew and became known in botanical and horticultural circles there came a steady stream of requests for uncommon plant materials from academic sources and commercial nurseries. Requests for research material range from wanting specialized plant parts, such as flowers or pollen, to wanting rare or unusual species often unobtainable elsewhere. It has been Arboretum policy to supply this type of material promptly whenever possible, although this has had to be curtailed in the last several years.

Nearly any plant in the collection is available to the nursery industry, the only exception being plants which are still under study by the staff, those which would be injured by the removal of propagating material and those under some state or federal restriction. Over the years, the Arboretum has supplied the nursery industry with plants, seeds, and propagating wood of numerous ornamentals, including hybrids developed by the staff and trees or shrubs new to the area. Since 1959 the Arboretum has had a column in the monthly newsletter of the Washington State Nurserymen's Association describing a rare or uncommon plant and offering propagating materials for it. The contribution provided by these efforts to the flora of the Northwest and the beauty of its communities represents an enrichment of incalculable value.

The Arboretum has supplied thousands of

trees and shrubs to the University campus, the Echo Glen School, the Woodland Park Zoo, and dozens of other state and city institutions.

Another way in which the Arboretum has served the public's horticultural interest is by providing space for special public plant sales. These are sponsored by the Arboretum Foundation, the Friends of the Arboretum, or local garden clubs. Sale materials are provided by these groups and the proceeds go to support their activities.

The physical aspect of the Arboretum provides benefits of yet another order. For the plant collections are intentionally structured not merely from a practical standpoint, but from an aesthetic one as well. The beauty and harmony of native and exotic plant groupings and their impact on the physiography of the landscape are paramount concerns. Hence, display is essential to the Arboretum, and especially in the Spring and Fall this is very spectacular.

The Arboretum display enables the horticulturally-minded citizen to see a wide selection of plants that can be grown in this area, giving him ideas for his own uses. To many people, the display alone is sufficent reason to visit the Arboretum, and they too are pursuing their plant interests.

Displays of plant materials have been extended away from the Arboretum grounds. The Arboretum has staged many special displays over the past twenty five years or more, ranging in size from a few rare specimens for meetings of professional plantsmen to large landscape displays for garden shows.

Radio and television programs also offer a means of public service that have been exploited by the Arboretum. As mentioned above, radio programs were among the first attempts at public service by the Arboretum. Regularly-scheduled radio talks continued until the early 1950's and occasional programs are still given. In more recent years television has replaced this medium and the Arboretum staff has participated in both commercial and educational TV programs. Two 6 and 9-week series on general gardening and conservation have been broadcast on KCTS-TV.

The collection of photographs and slides in the Arboretum's files have been widely used by commercial and professional magazines and papers including *Sunset Magazine,* Time-Life books and *American Horticulturist.* The Arboretum has contributed to many public-interest publications by the Friends of the Arboretum and the Arboretum Foundation.

THE FUTURE ROLE OF THE ARBORETUM IN PUBLIC AND COMMUNITY SERVICE

These are some of the public service activities which the Washington Park Arboretum has sponsored or contributed to in the past. But what of the future? The need is great and the opportunity is ripe to strengthen the Arboretum's public and community service roles.

In a second report to the State Legislative Budget Committee, dated October 16, 1972, the University elaborated on the public service, research and educational programs which could be continued and expanded in the Arboretum if the University could be given the opportunity.

In the educational area, public service opportunities for the future can be categorized into general adult education, children's programs, and programs for persons who are professionals in some aspect of the plant sciences. The quality and scope of possible education programs depend upon the available facilities in the Arboretum, the makeup and size of the professional Arboretum staff, the degree of input by University faculty members and lay people, and the degree to which the Arboretum maintains its dynamic viability as a research institution.

Adult education courses would be expanded to reach more people and to include a wider diversity of plant-related topics than have been presented in the past. In addition to traditional courses in taxonomy, plant breeding, propagation, cultivation, pruning, and plant nutrition, there could be offerings in plant diseases, insects, economic botany, local ecology, conservation, soils, landscape architecture, land management, artistic uses of wood, and others.

The courses would be strengthened by symposia and lectures, television specials and tele-courses in ornamental horticulture. Exhibits, displays, publications, and the use of the Arobretum's library provide further means to reach the public more effectively.

There is definitely an opportunity and a need for the Arboretum and its lay volunteers

to provide tours, demonstrations, and practical learning experiences to local school children. King County public school officials have recently suggested that further impetus be given these possiblities by establishing a resident school teacher in the Arboretum. In additon to teaching visiting school classes, this person would coordinate environmental education activities between King County Schools and the Arboretum.

Conservation and horticultural education programs for school children can be strengthened by actively involving the students in their own special projects. Through direct participation they can learn valuable skills and rewarding pastimes while increasing their awareness of natural processes. The Arboretum can provide unique opportunities for such programs and complement other facilities available to the schools.

Tied to this program, the Arboretum staff would provide courses and teaching manuals to school teachers throughout the Pacific Northwest. In this way the Arboretum can greatly expand its capabilities by the multiplier effect through the regional education process.

Education programs for professionals would be aimed at professional gardeners, park personnel, arboriculturists, landscape architects, highway designers, city foresters, nurserymen, and planners. Through courses, seminars, lectures, and field trips, these people could be informed of the latest developments in a variety of plant-related fields.

In addition to the educational media described above, there is also the important aspect of demonstration. The living collections of the Arboretum perform a passive educational role through the arrangement of plant materials and use of specimen labels. These could be augmented by the construction of an Interpretive Center in the Arboretum to introduce visitors to the grounds and to house special exhibits.

The University has long wished to develop a number of small demonstration gardens in the Arboretum. These could include special demonstrations such as comparative groundcover plants, mulches, street trees, hedges, roof gardens, container gardens, and plants which are susceptible or resistant to air pollution. Plans have been discussed with *Sunset Magazine* to develop demonstrations, but these have not come about due to the tenuous occupancy by the University of the Washington Park Arboretum and the ready susceptibility of such demonstrations to damage.

Besides the general education and demonstration roles of the Arboretum, extension services are important. The present problem-oriented service can be greatly improved by the increase in professionally-competent staff, which the University wishes to provide. The clinic approach is very effective in helping people with special problems. Both at the general public and professional levels, this direct service can be augmented by the preparation of pamphlets and bulletins.

In promoting the concept of a Regional Center for Horticultural Information, the University wishes to widen the scope of the Arboretum's activity to include the entire state. The problems of selecting suitable street trees in the Okanogan valley should be of equal concern to the Arboretum as the same questions for Bremerton or Bellevue. Because of the climatic and edaphic differences in various parts of the state the present staff feel inadequate to give advice in areas outside those west of the Cascades.

There are several ways in which to overcome this lack of knowledge: closer cooperation with the Research and Extension centers of W.S.U., coordination of satellite gardens under the control of the University or in cooperation with other institutions, municipalities, or governmental agencies, and extensive field work and research with local nurseries and skilled amateur gardeners. Actually, the Arboretum can diversify itself without great expense by developing such outside links.

In the context of the public service programs presented above, the objectives of the Arboretum are seen to be akin to those of a museum. The Arboretum is a museum of plant materials (living collections and herbarium specimens) whereas a "regular" museum emphasizes some remnants of the past and their relationships to man's present and future. However, the behind-the-scenes scientific work is similar, and the broad educational programs of such people-oriented institutions are identical.

Neither a museum nor an arboretum can be allowed to become static and inflexible and still retain its integrity as an institution. This is the whole point the University of Washington is making with respect to the future of the Washington Park Arboretum.

RELATIONSHIP OF THE ARBORETUM TO UNVERSITY INSTRUCTION AND RESEARCH

The public service roles described above are defined in large part by the Arboretum's interest in the relationships of woody plants to man's environment. This thrust can be strengthened by giving it a problem-solving orientation and by relating it to as large an area as possible beyond the geographical confines of the Arboretum.

These perspectives will be achieved *only* by a close alliance with the other academic resources of the University of Washington. The public and community service functions of the Arboretum are dependent upon the expertise, the facilities, and the plant collections which the University can assemble to meet its primary mission of student instruction and research. The varied talents which the University brings together provide the lifeblood of the Arboretum as an intellectual institution.

To fully comprehend the relationship of the Arboretum to the University of Washington, a brief explanation of the University's own educational and research interests is required. In a very real sense these too are public service enterprises.

The Arboretum has long played a supportive role in the educational programs centered on the University campus. For example, the Arboretum currently serves as a field laboratory for the teaching of a number of courses including dendrology, ornamental taxonomy, elemental botany and ecology. It has also been used effectively in such other educational areas as soils, plant nutrition, outdoor recreation, and landscape architecture.

New undergraduate programs are being discussed in the general area of applied botany. Students have shown a strong interest in fields such as urban forestry and horticultural botany. The need for these types of professional expertise in the management of urban and suburban areas is increasing. The Arboretum, located in an urban setting adjacent to the University campus, is ideally situated as a base for initiating such innovative new programs.

The University also has proposed to expand its past involvement in professional horticulture training by utilizing the professional staff, faculty, and plant collections at the Arboretum. This would be undertaken in cooperation with local community colleges and would be aimed specifically at job-training.

The University has proposed to implement these programs partially by the construction of appropriate facilities in the Arboretum, the appointment of Arboretum faculty in such plant science areas as genetics, entomology, pathology, physiology, and taxonomy, and the development of closer ties between the Arboretum and the faculties of other University departments.

Up to now, the latter-mentioned integration has never properly developed. In part this is due to the lack of facilities and University control in the Arboretum, but there is another deep-seated reason. Generally speaking, the advance of specialized knowledge has divided the intellectual life of universities. Large universities such as the University of Washington are large conglomerates, whose component parts often pursue separate purposes. The tradition of faculty individualism and independence adds to this condition.

The University of Washington, for one, has recognized that for certain purposes these conditions create problems, and it is attempting to rectify this by bringing the disciplines together where appropriate. It particularly values the Arboretum as a potential focal point for problem-solving in the environmental sciences. The various University colleges and departments can provide the framework for specialized research and instruction in the separate disciplines, but the presence of an energetic arboretum can "put it all together".

The Arboretum, therefore, has the potential to encourage research of a broad kind. Many of the complex problems of the natural and human environments require a multi-disciplinary approach to their solution. The Arboretum can maintain a well-defined and consistent focus, which uniquely qualifies it as an environ-

mental awareness center with a specialized concern for land management and the role of trees and shrubs in the civilized landscape. Research related to this concept should not be exclusively biological, but should include landscape architecture, sociology, law, political science, urban planning, economics, and other disciplines.

Research advances knowledge by the discovery of new facts or by combining known facts in new ways to form answers to new questions. Research is the core of the Arboretum's intellectual life, and must be integrated with its educational and public service activities and its displays. The degree to which relevant knowledge is acquired, assimilated, and transmitted will determine much of the Arboretum's influence in the academic and local communities.

The plant collections provide the basic materials for research in such areas as plant taxonomy, pathology, physiology, and genetics. Such research aims to "improve" plant varieties, develop new cultural techniques, and shed light on biological processes. The living collections of the Arboretum can be used as tools in the ecological studies of natural systems. The Arboretum's permanent commitment to its site, its ability to regulate the human activities which occur there, and its location in a metropolitan area would make it specially suitable as a field station and laboratory from which to observe the monitor long-term ecological change under the influence of certain human activities.

THE CONFLICT BETWEEN ACTIVE RECREATION AND ARBORETUM PURSUITS

With the history and potential of Arboretum public service, education, and research programs in mind, the inherent conflict between "park" and "arboretum" can be placed in focus.

The Arboretum provides a *unique* amenity to the citizens of the Pacific Northwest, and many visitors are attracted simply because of the satisfaction they derive from its very special nature. The displays, demonstrations, and ideas related to the plants are conducive to a passive, introspective form of recreation. The Arboretum provides a green island among the concrete steel, the monotony and bustle, the anonymity and strife of the urban environment. Hence, the Arboretum is attractive to many people because active, noisy recreation is not appropriate there.

The concept which distinguishes the Arboretum from a usual park is that parks generally exist to provide active recreational opportunities to the citizens of an area. Parks are a vital component of any community, but many park activities are not a vital part of an arboretum. Inappropriate uses detract from the Arboretum because University resources are diverted away from other arboretum functions to accommodate policing, sanitary, safety, guidance, and maintenance problems such as would be found in any park area.

This cannot be rectified by simply providing more money to take care of added burdens. The limited size and basic configuration of the area and the danger to valuable plant specimens from abuse, overuse, vandalism, and theft discourage arboretum activities. It is necessary to establish policies which safeguard unique arboretum functions and provide adequate measures to protect the plant collections. Intelligent management of physical access and the guidance of public use by proper interpretive and information facilities will help prevent conflicts.

In a positive step, the University in its October 16 report described what it considered to be a feasible solution and an effective compromise. Washington Park *is* a public facility and the University appreciates that it is desirable for it to remain as such. Recognizing the validity yet basic incompatibility of park and arboretum uses of the area, the University in that report proposed a partitioning of the Arboretum according to these uses. The road patterns and areas of highly developed collections in the Arboretum make Lake Washington Boulevard and the Broadmoor entrance road logical points to effect such a division. The acreage remaining as arboretum was proposed to be administered and operated by the University and the remaining area by an appropriate park agency.

(Continued on p. 33)

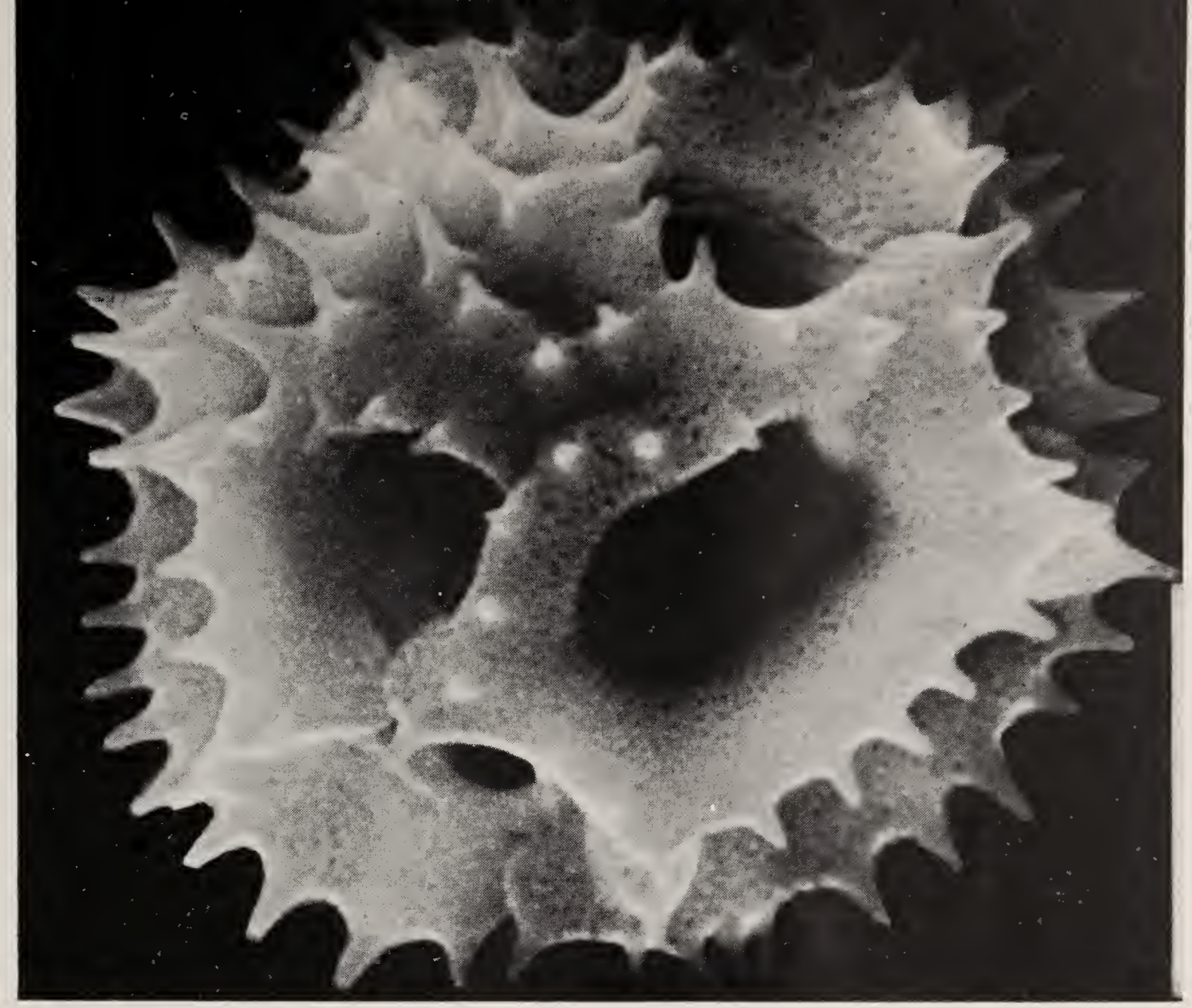

Figure 1. Picture of pollen grain of *Hypochoeris radicata,* a close relative of dandelion, obtained with the aid of scanning electron microscopy. Width: 10 m.
Photo by: Dr. F. Amelunxen; Courtesy of Dr. H.-F. Linskens.

What's New In Pollination?

B. J. D. MEEUSE *

Part Two

7. **BEHAVIOR AND METABOLISM OF POLLINATORS.** Although laymen think of insects as "cold-blooded animals", it has been known for more than a century that the temperature of an insect in flight can be much higher than that of the environment. Even in bumble-bees weighing as little as 100 milligrams, the temperature of the thorax (the front part of the body) can be maintained at a level of 20° Centigrade above that of the environment. Basically, the trick is done by producing heat internally. Indeed, metabolically speaking, the flight muscles of insects constitute the most active tissue known, and in many cases, the fuel they use is fat, a compound with a very high caloric value.

The best work so far on temperature control in flying insects has been done by Bernd Heinrich and associates with sphinx moths, mostly with adults of the tobacco hornworm, *Manduca sexta*. The larger sphinx moths weigh from two to six grams, which brings them in the size-range of the smaller hummingbirds. Except for their nocturnal habits, hawkmoths show striking similarities to these animals; e.g., they too feed on the nectar of flowers while hovering. The prodigious amount of energy required to drive the wings of a hovering *Manduca* moth at the rate of twenty-five to thirty beats per second can be produced by the flight muslces only when the latter are already at a temperature of 35-38° Centigrade. Yet, these sphinx moths (and the same is true for certain bumblebees) can be seen flying when the air temperature is as low as 10° Centigrade! The explanation for the apparent contradiction is that in a cold environment the insect, before

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*Part Two is the final installment of this stimulating article on pollination written by Dr. Meeuse, Professor in the Botany Department at the University of Washington and new member of our Editorial Board.

trying to take off, goes through a warm-up procedure resembling the shivering of birds and mammals. The wings are vibrated through a small arc, and if the air temperature is at least 10° Centigrade, the muscle contractions produce heat more rapidly than is lost to the environment, so that the temperature of the flight-muscles begins to rise. This warming-up of the flight-motor leads in turn to a higher rate of heat-production, and so on. Understandably the duration of the pre-flight warming-up period depends on the temperature of the environment: at 30°C., it is only a minute, but at 15°C., the insect may require 15 minutes. The *structural* features that make the warm-up possible are, in the first place, the presence of a dense insulating cover of long scales on the thorax, and secondly, the presence of a large air-sac insulating the thorax from the abdomen. Overheating of the thorax, which would lead to tissue damage, is prevented not by cutting down on heat production but by regulating the amount of heat-loss to the environment *via* the abdomen. The tubular heart, which in sphinx moths has a larger diameter and thus a larger capacity than in most other insects, extends over the whole length of the dorsal part of the abdomen and into the thorax where it continues as a large vessel, the aorta, looping through the flight muscles. As soon as the temperature of the thorax in a flying animal reaches about 44° Centigrade, it stabilizes, but at the same time the temperature of the abdomen begins to rise sharply. This must mean that the abdominal heart responds to the critical temperature of 44° Centigrade in the thorax. It begins to pump blood more energetically, and overheating of the flight motor is simply prevented by a faster flow of blood, which rapidly transports excess heat to the abdomen, from where it is rapidly dissipated to the air because this part of the body practically lacks insulation. The "sensor" controlling the heart rate and hence the dissipation of heat from the flight motor is located in the thorax, and exercises its control through nerve connections. In contrast to the situation in birds and mammals, only the thorax warms up in insects. At an air temperature of 20-25° Centigrade, an animal such as a bumblebee weighing 100 milligrams may warm up at a rate of about 10 degrees per minute, whereas a bird or mammal weighing 100 grams could not do better than about 0.3° Centrigrade per minute. For this reason, an insect can go through many cycles of heating and cooling in a day, while hummingbirds and very small mammals (if they display the phenomenon at all) usually pass through one cycle per day only. Animals heavier than 100 grams have warming-up rates that are too slow to fit even into a daily cycle.

Cruden, who recently (1972) studied the question why the frequency of bird-pollinated plants increases at higher elevations, found that under favorable flight conditions there is little or no difference in effectiveness between bees and birds as pollinators. However, at high elevations birds are the more effective agents during the rainy season because they tend to remain more active than bees at that time. The higher incidence of bird-flowers at higher elevations can therefore, at least in part, be attributed to their greater reproductive success which gives them a competitive edge over insect-flowers.

8. **ENERGY REQUIREMENTS AND NECTAR-EXTRACTION EFFICIENCIES OF POLLINATORS.** For a plant species which, for its seed production, is entirely dependent on cross-pollination, it is obviously important that a pollinator will to a considerable extent stick to individuals of this one species rather than scattering its flower visits over a whole array of different ones and thus wasting valuable pollen. Recently Wolf, Hainsworth and Stiles (1972) have investigated this problem in plants pollinated by hummingbirds, animals which at first sight do not seem to possess the extreme specificity for certain flowers displayed by (e.g.) Euglossine bees and some of the orchids.[1] In order to increase hummingbird specificity, plants flowering simultaneously in a given environment appear to exploit the principle of "differential extraction efficiency" (of nectar).

Extraction efficiency can be defined as the ratio between the energy a pollinator has to expend to obtain a certain volume of nectar and the energy (caloric value) which the animal can get out of that nectar. In favorable plant materials, such as the three *Heliconia* species

(Musaceae) used by Wolf, et. al., the latter value can easily be established while the energy used in foraging can be calculated from the cost of hovering (per gram of bird per hour), combined with the body weight and the amount of time spent in foraging. The latter time span depends, of course, closely on the "fit" between pollinator and flower, i.e., on the greater or lesser correspondence between shape and size of the corolla on the one hand and that of the bird's bill on the other. It turns out that at a given flower a particular species of hummingbird is more efficient than others, while conversely a given hummingbird species is more efficient at extracting nectar from some flower species than from others. On the basis of the plausible assumption that hummingbirds will indeed show a certain preference for those flowers that offer them "the most value for their money" (a preference that can probably be learned?), it seems safe to conclude that the situation *does* lead to the establishment of a certain bond between a particular hummingbird species and a particular species of flower, so that the latter will receive more visits from its "special" benefactor than other species do.

9. **APPLIED FLORAL ECOLOGY.** The development of methods for the management of wild bees effective in alfalfa pollination may well be the great success story in this area. The flowers of alfalfa (*Medicago sativa*), an originally Mediterranean plant which now is the most important legume in the United States, pop open with almost explosive force and produce a veritable cloud of pollen when they are "triggered" by sufficiently heavy insects such as bees which alight on the keel. Honeybees, which are not the original pollinators, soon learn to avoid the explosions, stealing nectar — the only product in which they are interested here — through a natural slit near the base of the flower. As a result, pollination and subsequent production of seeds will take place only in those flowers which honeybees trigger by mistake. In many areas of the United States this amounts to only five percent of the total number. It is very fortunate indeed that among the wild bees man has found two important allies willing and able to take care of alfalfa pollination: the alkali bee *(Nomia melanderi)*, native in the arid parts of our Northwestern states, and a leafcutter bee, thus far indicated as *Megachile rotundata* (more correct name, probably: *M. pacifica*) which was accidentally introduced from eastern Europe in 1947. Outstanding work, which among other things has led to the virtual domestication of the introduced leafcutter bee, has been done by entomologists of the United States Department of Agriculture, especially by G.E. Bohart and W.P. Stephen.

Alkali bees do indeed show a preference for those spots in arid regions where water seepage and strong evaporation lead to the deposition of alkaline crusts so that plant growth is very sparse. Although technically known as "solitary bees", the females are gregarious in the sense that tens of thousands of individuals may dig their burrows and construct their brood cells in the soil in regular "bee cities". In the management of these bees it is crucial to maintain an optimal level of soil moisture so that the females' digging may be facilitated.

All members of the genus *Megachile*, which is widely distributed in North America and Eurasia, are important pollinators. In contrast to honeybees, which possess pollen baskets on their hind legs, female leafcutter bees collect pollen in hairbrushes found on the underside of their abdomen. Their popular name "leafcutters" or "paperhangers" refers to the fact that the females, with the aid of their powerful jaws, cut very regular circular and oval pieces out of leaves or flower petals. These fragments are then used for the construction of a whole series of brood cells in natural or man-made cavities such as nailholes, the cavities found in old dahlia stems or lengths of thin bamboo, etc. The circular leaf pieces are used for making the cross walls, the oval ones for lining the sides of the cavity. Each cell receives one leafcutter egg, plus a supply of the nutritious nectar and pollen mixture known as beesbread, on which the developing larva will later thrive). (fig. 4) In 1960, it was found that females of the introduced leafcutter were willing to occupy holes deliberately drilled in the wooden walls of a cabin. Nowadays, the animals are usually induced to occupy blocks of wood or plastic in which a large number of holes of the right diameter have been drilled close to one another

(fig. 6). An alternative method is to use bundles of soda straws placed in a milk carton, or even stacks formed from pieces of corrugated cardboard. Such "housing developments", complete with tenants, are now commercially available; collected when the brood is at the right stage of development, they can be shipped from place to place to serve in alfalfa seed production.

10. **NEW TECHNIQUES IN ANTHECOLOGY.** One of the really great strides forward has been the development of scanning electron microscopy, a technique which enables us, among other things, to obtain pictures of pollen grains with a three-dimensional effect (fig. 1, p. 15). Dramatic photographs of pollen grains germinating on a stigma and sending their pollen tubes into the latter's papillas have also been obtained.

The fact that a TV camera, like the eyes of some insects, is sensitive to ultraviolet light (UV) has been exploited with great success by Eisner and collaborators (1969) in the study of UV-honeyguides. When the TV-camera is equipped with an appropriate UV transmitting lens, it can be used for the direct examination on the monitor screen of UV-reflection patterns which are normally invisible to us although they are visible to insects. To budding floral biologists, the first such screen view of a meadow in mixed bloom is unforgettable. Admittedly, direct UV photography of flowers yields sharper images, but that technique is much more laborious. Also, for classroom demonstration of UV-honeyguides the advantage of the TV-camera method is simply incalculable.

To gain insight in the efficiency of hummingbirds as distributors of pollen, Schlising and Turpin (1971) have employed radio-active iodine (I^{131}) which was applied directly to fresh pollen on stamens of living *Delphinium cardinale* plants and subsequently traced and recorded on other plants in the field. In one experiment, 137 flowering stems were present in a circular study area 22 meters in diameter and 18 lambda of radio-iodine was applied to 18 flowers on a single plant in the center. Twenty four hours later, radio-active pollen was detectable in two thirds of all the flowering stems in the area! It is obvious that, as the result of the hummingbirds' activities, pollen from very few flowers and plants can quickly reach a large proportion of the individuals in a population. The importance of this in studies concerned with "gene-flow" and population genetics is immediately clear. Iodine ^{131} has a very short half-life and was clearly harmless in the set-up described. Very scrupulous persons, however, may in the future wish to explore a method advocated by Berry and collaborators (1972) in which plants are fed rubidium, a harmless element which behaves very much like potassium and is easily traceable.

As already mentioned, gas chromatography has been used successfully in the study of orchid fragrances. It has also been employed, along with filter paper chromatography, thin layer chromatography and enzymatic methods, in the analysis of the various sugars present in nectars.

11. **FINAL REMARKS**: To some extent this article — deliberately kept sketchy — complements my book "THE STORY OF POLLINATION" (Meeuse, Ronald Press, 1961). It presents recent developments as well as some aspects of anthecology which in the past I have covered inadequately. In its very early stages pollination ecology was characterized by a strong preoccupation with the beautiful "fit" between certain flowers and their pollinators. Although enthusiastic naturalists kept expanding the list of examples, this "ain't nature wonderful" approach did ultimately lead to a certain scientific stagnancy and to the well deserved charge that our branch of science was becoming a pastime for retired schoolteachers. Anthecology was saved from this impasse when scientists turned their attention to the dynamics of speciation in flowering plants. It now appears that we are in a third stage, characterized by an emphasis on ecological-physiological and biochemical matters, which are evaluated in a much more quantitative manner than was the case in the past. It can thus truly be said that anthecology has become the meeting-ground for a variety of other disciplines and is emerging as a multicolored tapestry of infinite detail and charm. May it continue to attract persons like Sprengel and von Frisch who have added so

much artistry and, yes, poetry to good sound science.

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[1] *Arboretum Bulletin,* Fall, 1972. pp. 8-9.

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Applied Floral Ecology

Figure 2. Photo by: Howard Potter

Figure 5. Photo by: W. P. Nye

Figure 2 Female of th
The flowers
show quite
the keel.

Figure 3 Egg of the le
in brood-cell

Figure 4 Brood-cell o
cut out leaf-p

Figure 5 Female of th
piece of leaf.

Figure 6 Artificial ho
rotundata.

Figure 3. Photo by: W. P. Nye

Figure 4. Photo by: W. P. Nye

afcutter bee *Megachile rotundata* on alfalfa flower.
he foreground have already been "triggered" and
ly the column of stamens that has popped out of

utter bee *M. rotundata* sitting on clump of beebread
d with leaf-fragments.

e leafcutter bee *M rotundata* showing the lining of
s as well as the clump of beebread and the larva.

afcutter bee *M. rotundata* entering nest-hole with

g-development (12 nests in groove board) of *M.*

Figure 6. Photo by: W. P. Nye

ARBORETUM CLASSES, Spring, 1973

PRUNING ORNAMENTALS Mr. Chico Narro, expert nurseryman, will demonstrate techniques for pruning trees and shrubs. Arboretum greenhouse; class limited to 30. Saturdays, March 24 and 31; 10-12 noon. 2 session, $5.

SPRING TOURS Mr. Joseph A. Witt, Assistant Director of the Arboretum, will conduct tours of the Arboretum grounds in spring bloom, including Japanese cherries, rhododendrons, and azaleas. Class limited to 25. Saturdays, April 7, 28, May 12, 26; 11 a.m.—1 p.m. Meet at Arboretum office. 4 sessions, $5.

NATURE PHOTOGRAPHY Mr. Donald Riecks, Director of University of Washington Audio-Visual Services, will lead this series, discussing techniques of photographing plant materials under varying conditions of space, season and weather. Class limited to 20; meet at Arboretum office. Saturdays, April 14, 28, May 5, 19; 11 a.m.—1 p.m. 4 sessions, $10.

INSECT PESTS OF ORNAMENTALS Ms. Sharon Coleman, Entomologist, will teach this class on insect pests of the Puget Sound area. Topics covered will include insect identification and life styles, beneficial insects, garden ecology and control of common garden pests. Last class will be field trip. Class limited to 25; 107 Winkenwerder, UW campus. Saturdays, April 7, 14, 28, May 5, 12; 9—11 a.m. 5 sessions, $10.

SUMMER CUTTINGS Mr. Richard van Klaveren, Arboretum propagator, will teach seasonal techniques for propagating woody plants. Materials will be furnished. Arboretum greenhouse; each section limited to 10. 2 sessions, $10.

Section A: Saturdays, June 2, 16; 9:30—12:30 p.m.
Section B: Saturdays, June 9, 23; 9:30—12:30 p.m.

TO REGISTER: Send check, made payable to the University of Washington, to Arboretum Courses, Anderson Hall (AR-10), University of Washington, Seattle, WA 98195

FOR FURTHER INFORMATION:
Call 543-2730

This is your Arboretum, kept alive by your support

We are pleased to welcome the following new members (October 1, 1972 through December 31, 1972): *Sustaining* — Mrs. William Todd Cahill, Mrs. W.G. Coulter, Mrs. D. Eugene Hokanson, Reverend and Mrs. Stuart C. Pastine, Pleasant Valley Garden Club. *Annual* — Mrs. Harold N. Andresen, Mrs. John Balk, Mrs. Fred J. Beck, Mrs. Phillip L. Beatty, Mrs. Herbert H. Bentley, Mrs. C.W. Blain, Mrs. Carl E. Brazier, Jr., Mrs. Kermit E. Brenden, Mrs. H.R. Breshears, Mrs. O.N. Browne, Jr., Mrs. Tom Chambers, Mrs. Dick Clarke, Mrs. Timothy M. Crow, Mrs. E.A. De Wilde, Mrs. John R. Eldredge, Mrs. Rodney W. Epps, Mrs. Austin Farrell, Mrs. George G. Frazier, Mrs. A. Gamble, Mrs. Edward Harvey, Mrs. Hunter Haselton, Mrs. Edwin H. Hearing, Mrs. George Hoke, Miss Marjorie Johnston, Mrs. C.E. Kettells, Mrs. Daniel Kohli, Mrs. Hals Larsen, Mrs. Richard Lundgren, Mrs. William H. McCulloch, Jr., Mrs. Clifford W. McGuire, Jr., Mrs. Henry B. Morris, Mrs. F.M. Muro, Mrs. Joe G. Norman, Jr., Mrs. David C. Oak, Mrs. Francis J. Pelly, Mrs. J.E. Pennington, Mrs. John L. Petersen, Mrs. Haakon Ragde, Mrs. Frank Ramisch, Mrs. Russell Rohwer, Mrs. Douglas R. Scheumann, Mrs. F.E. Schultz, Mrs. Stephen Simpson, Mrs. Paul O. Snyder, Mrs. George A. Stams, Mrs. Richard K. Stearns, Mrs. Hans L. Stern, Mrs. Adrian L. Stevens, Mrs. A.F. Sulak, Mrs. David A. Taft, Mr. Chauncy Taylor, Mrs. Alan L. Van Buskirk, Mrs. W.L. Weller, Mr. & Mrs. H.S. White, Mrs. Ralph Williams, Jr.

We are also grateful to the following members who have increased their dues to: *Supporting* — Mrs. George W. Taylor. *Contributing* — Mrs. Noble Hoggson. *Sustaining* — Mrs. E.W. Andrews, Jr., Mike Bassett, Mrs. Leonard Foley Eshom, Mrs. R.J. Helberg, Mr. & Mrs. Ed Janhuen, Mrs. George Ryan, Mrs. Archibald W. Talbot.

FRANCES W. MACBRIDE

Frances Macbride (Mrs. Philip D.) became an active member of the Arboretum Foundation in 1935. Her enthusiasm never diminished! Serving for many years on its Board she later became an Honorary Board member. An interest in beautification and a concern for environmental problems gave impetus to her many and varied activities. Besides her deep love of gardening she felt a profound desire to share with others the fruits of her labor. She would come to a meeting with an armload of cut flowers or greens or a blooming cyclamen or some small specimen she had nurtured. Those who visited her garden never went away empty-handed.

A unit in the Foundation was named the Frances Macbride Unit in her honor. She made contributions to the *Arboretum Bulletin* as well. Because of her innate interest in people she shared her knowledge of horticulture with all who came within the radius of her enthusiasms.

A member and past president of the Seattle Garden Club, Mrs. Macbride was the recipient of the club's bronze medal and later its gold medal, "for ability in gardening and inspiration to others." She was a member of the Lake Washington Garden Club as well. The Garden Club of America bestowed upon her the National Horticultural Certificate. She served on its National Parks Committee and later as a Board member.

For her unfailing good humor, her friendliness and buoyant personality she still lives in the memory of her host of friends. Frances Macbride not only found her garden a delight but she shared it with others.

ROSAMOND P. ENGLE
(Mrs. Allen B.)

MYRTLE THORGRIMSON

Myrtle Thorgrimson (Mrs. Oliver) was a charter member of the Arboretum Foundation and served for many years on the Board of Directors. Both she and her husband were among those who helped to establish the Arboretum.

A knowledgeable and keenly interested horticulturist, she shared her knowledge and over the years wrote many articles for the *Arboretum Bulletin;* she was a Life member of the Bulletin Editorial Board. An Arboretum Unit was named for her and the Thorgrimson Cup is awarded annually to the Arboretum Unit that has done the most for the Arboretum.

She was a charter member of the Lake Washington Garden Club and a member of the Seattle Garden Club. For many years she was an active member of the Garden Committee of the Children's Orthopedic Hospital.

Her own beautiful garden was always open to those who shared her love of propagating and the growing of new and interesting plant material. Her generosity and enthusiasm will be greatly missed.

MRS. REX PALMER

THE OLIVER B. THORGRIMSON CUP

The Oliver B. Thorgrimson Cup, given to the Arboretum by the Myrtle Thorgrimson Unit, No. 49, is awarded annually to the Unit doing the most for the Arboretum during the previous calendar year. From the Winter, 1961 *ARBORETUM BULLETIN,* (Vol. XXXIV, No. 1, pp. 120 - 121) we quote:

> The nature of any project, the work accomplished or funds raised for some particular purpose, as well as the size of the Units concerned, will be taken into consideration in making the award.
>
> The Committee will consist of:
>
> (A) Three members from the Unit Council
>
> (B) Two members from Unit No. 49
>
> (C) The Executive Secretary of the Arboretum Foundation

(D) The Director of the Arboretum, to act as Chairman.

Any Unit wishing to compete for this cup must submit details of their achievement for the previous year, by March 1, to the Executive Secretary of the Arboretum Foundation. The Committee will meet and select the winning Unit during the following month. The name and details of the selected Unit's accomplishment will be published in the *ARBORETUM BULLETIN* and the trophy presented at the May meeting of the Unit Council.

This past year the trophy was won by the Mercer Island Unit 17 whose chairman was Virginia Montgomery. The following is a resume' of their activities which resulted in their small unit of 18 members being named the recipient of the trophy for 1972 - 73:

UNIT PROJECT	Hours
(Continuation of 1969 and 1970)	
25 concrete planters made, planted and donated to the May plant sale (a few were left empty by request).	46
ARBORETUM ACTIVITIES	
Two members were Chairman and Co-chairman of Work and Fun Day in April. Six members contributed time for maintenance work.	41
Various members contributed time in several departments during the plant sale. Our unit was in charge of the very successful food concession one day.	56
One member served as chairman of the Tour Guide program, active in training and guiding groups.	113
Seven members had "Weeding Party" in Loderi Valley in October	17
One member assisted committee in making containers and ararranging fall leaves and berries for hotel rooms of Dendrology Conference visitors	7
RELATED ACTIVITIES	
Hostesses at Unit Council Luncheon	8
Unit Board - One member was Work and Fun Day program chairman for the year.	12
Attendance at Board Meetings.	8
Unit Council Meetings	6
TOTAL HOURS:	314

CASH CONTRIBUTIONS	
Plant Sale — planters sold by pre-order	$ 25.25
Donation to Greenhouse Committee	50.00
Donation to Mr. Mulligan for maintenance	25.00
	$100.25

Congratulations to Unit 17 for their diversified efforts which won for them the Oliver B. Thorgrimson Cup! We never cease to marvel at the devotion and dedication of our Unit members, and hope that this year's Committee will be inundated with letters of application. ▲

Oliver B. Thorgrimson Cup. Photo by: William Eng

UNIT CONVERSATIONS

Do you have the winter blahs, feel housebound and depressed? Don't be — let your thoughts turn to spring and the annual Arboretum Plant Sale on May 3rd and 4th. Plant Sale Chairman Ruth Vorobik (Mrs. C.E.) and all her committee are excited because they have the opportunity to present to all of you attending the sale an array of plant material that you are not likely to see elsewhere; plants which have been selected as being new, unusual of notable performance for this area; plants which are considered especially beautiful or which will improve your surroundings; plants which are useful, edible, entertaining — and that very special material selected by our people and grown by our dedicated greenhouse crew.

The Donations Committee, a knowledgeable threesome, Lee Clarke (Mrs. Fred) AD 2-1264, Sue Peterson (Mrs. John) AD 2-8046, Marge Clausing (Mrs. H.P.) 826-8335 are having an exciting adventure going into the older established gardens of the Northwest and procuring rare and unusual plants for our sale. You will find it exciting to own a plant grown in the garden of Donald Graham, Franz Nehammer, Conner Gray or other show places of Seattle. Do you have plants to share? Maybe your garden is too crowded, or plants need dividing or you have a choice plant you wish to share. If so, please call a member of the committee.

The Greenhouse Committee, under the chairmanship of Ruby Williams (Mrs. W.E.) has been taking cuttings and is growing many sought after and unusual plants.

Do you need a certain plant and have not found it locally? If so, why not place an order with our Pre-Order Chairman, Jeannine Curry (Mrs. James A.) at PA 5-2708 or send a letter to the Arboretum Foundation office. This committee will be happy to search for the plant material you desire and have it reserved for you at the plant sale.

If your garden is well established and chockfull of plants, then come and visit our House Plant or Bonsai sections. There is something for everyone — even a Children's corner!

Perhaps you would like to work and be a part of the Spring Plant Sale, maybe selling plants, being a cashier, driving customers to the parking lot; if so, please call Chairman Ruth Vorobik at LA 3-4453 or Assistant Chairman, Marlee McKibben (Mrs. Bruce H.) at 885-2845.

Unit #54 had a most unusual money making scheme. They invited all interested Arboretum members, neighbors and friends to a Holiday Tea, at which they sold articles they had made or collected: fresh green door swags (one member had a huge evergreen); living Christmas trees (dug in the mountains); teasel trees (gathered in Eastern Washington); barnacled seashells with dried flower arrangements; pinecone owls; dish gardens (with rocks from the Frazer River) and many more interesting gifts. Marilu Barden (Mrs. Robert H.) their chairman, says they are "tramps" collecting wherever they go. She also stated that having workshop projects creates unity in the group. In spite of the fact their Holiday Tea day was a snowy one, this group of 30 women made around $350.00. They are already planning next year's affair and are collecting new ideas and material.

The Unit Council has sponsored a very popular series of lectures by Mrs. Franz Nehammer. The fourth Monday of every month Mrs. Nehammer has been lecturing to a group of about 65 women at the Puget Power Auditorium in Bellevue, on plant material and their garden relationships. In her charming and knowledgeable manner she has shown the class the relationship of the same plants during the changing seasons of the year. The class will continue through May.

Mrs. Edward G. Morgan

WORK AND FUN DAZE

Here it is almost Spring again with a brand new crop of weeds already to sprout. Let's all get into our Work and Fun "Daze" and help with spring cleaning in the Arboretum.

We have two works days scheduled this year. The first is Wednesday, April 18th, starting at 9:30 A.M. with lunch and prizes around 12:30; then more weeding, 'til your husbands and

sitters start calling! Perhaps you can top the winner of our Fall Work and Fun Day for the most unusual object found while weeding. Lillian Lindeman from the new Brian Mulligan Unit #79 found a plastic flower! Ruby Williams donated several plants from the greenhouse as prizes for the longest hours worked, and since Unit 79 also won all these prizes, let's give them some competition gals!

Wear an original creation for the hat parade, bring tools, lunch, and friends, not necessarily listed in the order of importance. "Weed Recycling Day" or "Kill the Diehard's Day" will be May 14th, also 9:30 A.M. 'til you drop.

With the remote possibility that one or more of these two days is inconvenient for your unit, you may call Joe Witt at the Arboretum office, 543-8800 or Lee Clarke, AD 2-1264 to arrange another day when your girls could work. You will still be eligible for prizes for the longest hours worked.

Let's all turn out and help make the Arboretum look its best for the coming year.

"Please promise you will never say—
I couldn't weed on Work and Fun Day!"

Mrs. Fred G. Clarke
Work and Fun Day Chairman

NOTES ON THE APRIL 30, 1972 FINANCIAL STATEMENT

We call your attention to the financial statement of April 30, 1972 which appeared in the fall issue of the Arboretum Bulletin. Anyone looking at the statement would assume that the Unit Council showed a tremendous loss on the Plant Sale. The report shows revenues received for Plant and Blub sale $5,280.90 and disbursements totalling $12,774.11. These figures are correct but due to the difference in fiscal year endings between the Arboretum Foundation's books and those of the Unit Council, it does not reflect the actual profit from Plant and Bulb Sales.

The 1971 Spring Plant Sale was held in early April, 1971 and the proceeds from the sale was shown on the prior year's report. The bills for this sale were paid in May and June of 1971. There is also approximately $2,100.00 in costs that were prepaid for the 1972 Plant Sale on this statement. The 1972 sale was held in May the month after this statement was prepared.

For your information, following are the net profits that the Unit Council made on Plant and Bulb Sales:

1971	Plant Sale Net Profit	$10,963.63
	Bulb Sale Net Profit	1,049.67
	Total Net Profit	$12,013.30
1972	Plant Sale Net Profit	15,128.04
	Bulb Sale Net Profit	1,550.37
	Total Net Profit	$16,678.41

We trust the foregoing clarifies the financial statement in regards to Plant and Bulb Sale figures.

MRS. JOHN SUNDBERG
Finance Chairman
Unit Council Governing Board

"The quest of the great naturalists was not only their quest, but ours. We are, each of us, a participant in the long voyage from the unknown to the less unknown, seekers for the answer to 'the question of questions' [Thomas H. Huxley, Man's Place in Nature] for mankind. Where the search will lead, we cannot predict. Whether we will be successful, we cannot be sure. Only one thing seems certain. The ultimate truth will probably always elude us, no matter how long the human race endures, for truth like the universe, appears to be infinite and has no boundaries. Therefore, the quest of the naturalists, just like the personal quest of each of us, will prove endless. It is the knowledge of this endlessness that demonstrates the courage of man and the dignity of his spirit."

Alexander B. Adams, Eternal Quest, Putnam, N.Y., 1969. p.434.

ARBORETUM SPOTLIGHT

Stewartia pseudo-camellia

That this is a valuable small tree for its large white camellia-like flowers during the latter half of June is well recognized, as well as the display provided by the conspicuous orange to maroon -red coloring of its foliage in late October.

Another decorative and interesting feature is to be seen in the development of the fruits (capsules), as they gradually change from a closed fleshy state and green color in August and September to a completely dry and brown condition in November, December and January. The conical, angular capsules split open to release the thin, slightly winged seeds during October, but often remain on the tree until the following spring or summer. When adorned by snow they are particularly charming, but unfortunately this effect does not usually last long in the Seattle area. On older plants the peeling bark is another unusual and ornamental character during the winter months.

This tree is native to Japan, excepting the most northerly island of Hokkaido, and was introduced to the United States by Thomas Hogg about a century ago. Plants were first acquired for the Arboretum in 1945 and set out in the spring of 1949 in the camellia garden, where they obviously enjoy the sandy type of soil and shade during the afternoon in the summer.

B. O. Mulligan

SOME OF OUR FAVORITES
Won't You Send Us Yours?

Stewartia pseudo-camellia

JACQUELINE NEHAMMER *

Selecting a favorite plant presented a problem: one that would measure up to critical appraisal of being worthy of aesthetic value throughout the year. I believe any plant of woody structure should offer at least three seasons of interest to have a place in the garden landscape. Thus I have selected *Stewartia pseudo-camellia* to have the spot light here. This is a small tree, from Japan, of sturdy, but not heavy, upright growth, suitable for the average size garden in scale. It is deeply rooted so planting close around the trunk is no problem. In our garden of sandy loam it has no pest or diseases to worry about. I do believe a wet clay soil is not too desirable. Most books suggest woodland planting, but of the two I have the one in the sun is more productive of both flower and autumn color.

As I write this it is winter with snow outlining the ascending branches, branches of open pattern, never twiggy, and a beautiful silhouette against a dark green conifer. When the snow disappears the light brown branches are an extension of the tree trunk. The trunk is one of its outstanding features and should not be hidden by tall growing plants. The old bark flakes off leaving an interesting mottled brown-to-beige finish.

As spring swells the shiny leaf buds and the warmer days brings the unfurling of light chartreuse leaves, a nice contrast to the more somber green background. Early one notices the flower buds developing in the axis of the leaf buds and from late June to August they open a few at a time. If planted where you can look down upon the branches these delicate open flowers, resembling single camellias or fringed paper-thin poppies with tufts of yellow stamens, are a delight at a season when few trees are flowering.

Autumn is the season when the *Stewartias* have their most magnificent display. From the green of summer they change to brilliant yellows, oranges and scarlets. This display is not too fleeting but lasts for several weeks.

Thus the full cycles has come and we again anticipate the bare branched silhouette of a lovely and rewarding tree.

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*Mrs. Franz Nehammer, a new member of our Board of Directors in June, 1972, needs no introduction to our readers. Her classes and programs are always SRO events; she shares her knowledge and love of plant material in a gracious, charming manner. That her choice of a "Favorite" is the same as that chosen to appear in "Arboretum Spotlight" we think is a happy coincidence!

SPRINGTIME IN JAPAN

The response to the Arboretum Foundation sponsored Japan Tour last October was overwhelming, and a group of 30 members visited Japan and other countries of the Orient. Because of the success and tremendous interest, the Foundation is sponsoring a similar program in April, featuring a different aspect of Japan's beauty — "Springtime". As last year, the total cost includes a $100 tax deductable donation to the Arboretum Foundation. For the complete itinerary or additional information call the Arboretum office or contact Marguerite Sherman.

Ten Feet High – and Growing!

Pablo Abellera and his dahlias are no strangers to members of the Arboretum Foundation. A small, semi-retired man, Pablo daily goes about his appointed tasks with a quiet devotion and dedication to purpose that many could emulate. So successful has he been in this purpose that the American Dahlia Association on September 10, 1972 awarded him a special commemorative plaque at their Annual Meeting in Corning, New York for his "loyal and devoted service" and for outstanding contributions to the development of dahlias.

For many years Pablo's "stand" at plant sales has been one of the most popular spots to be found. When the sales were held in the fall, his corner was a birght spot of color as he exhibited his choice blooms and took orders for tubers to be delivered later. Now, spring sales also find Pablo a cheerful and eager salesman of his colorful blooms, some as large as dinner plates and others small button or pom-pom shaped flowers. Always Pablo has shared his horticultural knowledge with those purchasing his tubers. A large portion of the proceeds of his sales has been contributed to the total proceeds of the plant sale.

Pablo's efforts have not been limited to plant sales alone. In fact, that represents only a small part of his contributions. Growing his dahlias on a small plot adjacent to the University of Washington Hospital, it is inevitable that his flowers find their way daily to brighten some office or to cheer a patient or to greet a visitor. It has been estimated that he plants over 1000 tubers in the spring and during the summer months cuts from four to six thousand dahlias for others to enjoy.

He is busy doing more than cut his flowers, however, for Pablo's placque was, in part, recognition of the hybridization efforts that he has done and continues to do, striving always for that perfect bloom. Samuel H. Pope in the November, 1972 issue of "Hospital News"

wrote this of Pablo's work in dahlia hybridizing:

Hybridization in dahlias is done by placing pollen from one flower into the open spores of another flower of the same variety. The pollenized flower is then marked with the specifics of that effort, colors of the blooms involved, types, date, etc., and it is left on the plant until it dies. After the petals fall off, the pollenized center portion closes up and continues to mature, drying slowly on the plant. In the mid-fall, at the end of the growing season, the marked blossoms are harvested and during the winter, dried seeds from within the blossom are removed and planted in seed flats, again marked as to the specifics of the pollenization that created them. Then, in mid-May, the new sprouts are planted in the dahlia garden as seedlings and evaluated over the next summer when the first blossoms appear. Good combinations, bad combinations, indifferent combinations. Some are borderline and they can be tested through another season to see if they improve with greater maturity. Perhaps a small number of the several hundred hybridizations will be kept for several years. Perhaps a couple will show the characteristics which Pablo is searching for and will receive names and possible fame. In 1962 Pablo won the annual trophy from the American Dahlia Society for his hybrid named Seafair Guest. Ten years later, this hybrid has disappeared, mutated or changed from its original prize-winning loveliness. Other good strains may not last even that long.

Despite the beauties of shape, size and color, Pablo's chief concern with new hybrids is the stem. Is it straight and strong enough to support the beautiful blossom without bending? In his customary, colorful manner, Pablo Abellera emphasizes this important point with a flourish, 'It's like in horse-raising,' he says. 'You got no legs, you got no horse.'

The Arboretum Foundation congratulates Pablo Abellera on his beautiful plaque! We know that is is most surely well-deserved. We know too that it represents hours and hours of labor, of experimenting, of joys and disappointments, of obstacles surmounted. To Foundation members he will always be TEN FEET TALL – AND GROWING!

– Doris Butler

OUR READERS WRITE . . .

From time to time the Editorial Board will share with you comments from readers — in this case, literally, from far and near.

From Roberto Tamara, Librarian of the *Institute of Conservacao,* Rio de Janeiro — Guanabara comes the following:

We are pleased to acknowlege the receipt of two consecutive issues (Winter, 1971 and Spring, 1972 — two copies of each) of your "Arboretum Bulletin" and we thank you very much for the kind sending of this new and valuable addition.

The enclosed coloured plates in the Winter issue constitute a remarkable innovation! Very interesting is also the article by Howard S. Irwin, transcribed from the Garden Journal, not available for us. Both the copies containing this article are wandering yet from hand to hand, being read also by our colleagues from several affiliated institutions.

Mrs. Percy Guy, a new member of our Editorial Board who wrote on "Bog Pals" as "Favorites" in the Fall, 1972 issue of the *Bulletin,* received a most interesting letter from Jim Lawless, Seattle, Washington relating his experience in cultivating her "Favorites." The following paragraphs are from that letter:

Your article concerning Labrador Tea and Bog Kalmia (*Arboretum Bulletin*, Fall, 1972) was most interesting. My own specimens were collected from bogs near Pacific Beach and Aloha, Wash., about ten years ago. These bogs are readily visible from the county roads, and very common in the logged-off land near Iron Springs Motel.

Mr. Clarence Burlingame, who operated a small nursery near Humptullips, gave me a tip on cultivation of Bog Kalmia. The idea is to trace the long, bare stems back to a reasonable root wad, dig up the plant, and when replanting, bury everything . . . bare stems and foliage . . . an inch or two deep, leaving only four or five inches of the densely foliated shoots above ground. Coil or bend the bare stems so the exposed parts make a rather dense clump. As the plants grow, and more bare shoots develop, bend them down and bury them, leaving the tips above ground.

By following this advice, I have developed low, very dense mounds of Bog Kalmia, which bloom very freely. When so cultivated, I consider Bog Kalmia a choice shrub for the garden, very showy in bloom, with an agreeable evergreen character for the rest of the year. I moved my plants while they were in full bloom. The same tactic worked very well with my Labrador Tea, which mades a dense display of blooms.

Bog Kalmia and Labrador Tea require from 3/4 to full sun. They like plenty of peat moss in the soil. In the wild, both are very straggling plants with widely separated blooms and very scant foliage. Cultivation by Mr. Burlingame's method transforms them into to prize items. The labor involved is very small. The scrawny stems are buried once a year, immediately after flowering, during the course of routine weeding.

Brian Mulligan notes the following from *Beretning om Botanisk Haves Virksomhed for Aret,* 1971, p. 34 of the annual report of the University Botanical Garden in Kobenhaven, Denmark. Professor Dr. Thorv. Sorensen is Director of the Garden and presumed author of the report from which these paragraphs are taken:

Some excitement was caused in Summer 1971 by the flowering of *Eucryphia glutinosa* (Poepp. & Endl.) Baill. (*Eucryphiaceae*) from Chile; the large white flowers are terminal, with parts in fours and a large number of yellow, projecting stamens. It was fascinating to follow the unfolding of a flower bud, during which the calyx is pushed off like a hood. The four plants in the Garden have grown from seed sent originally by the University of Washington Arboretum in 1958. The seeds germinated rapidly into well-developed seedlings which by 1959 were ready to be planted out permanently in the bog below the North East side of the old embankments, protected by old conifers.

Over the twelve years since planting, the shrubs have reached a height of 1.75 m. The plants are best considered as half-evergreen, although after a hard winter they lose the older leaves in spring. However, even in rather hard winters, the plants have not shown any signs of frost damage.

Dr. Syrach Larsen reports that a number of years ago plants of the same species were established in the Forst Botanical Garden at Charlottenlund from seed sent by Kew Gardens but did not survive the bitter winters of 1939-42.

From Anchorage, Alaska, dated October 31, 1972 comes the following:

After some information I found you will publish an account of the plant exploration in Siberia in 1971. [*Arboretum Bulletin*, Fall, 1972, p. 2 "Plant Collector in Siberia", by Dr. John L. Creech.]

Please if you did already send me a copy I would very much appreciate.

Thanking most respectfully I am
/s/ Fermo Albertini

The Editorial Board is always pleased to hear from our readers. If you should care to share reactions to an article or experience with us, we should be pleased to received them.

Wintry boughs against a wintry sky;
Yet the sky is partly blue
And the clouds are partly bright.
Who can tell but sap is mounting high,
Out of sight,
Ready to burst through?

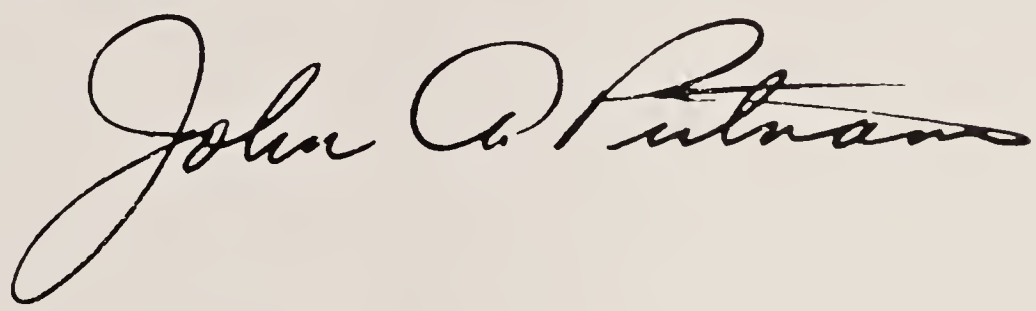
Christina G. Rossetti

President's Message

(Continued from Inside Front Cover)

a recommendation to the Mayor and the City Council. They have met three times and will meet twice weekly until the recommendation is formulated. I am confident that by the time the next *Bulletin* reaches you, an arrangement will have been worked out and we will be able to go on to other matters such as participating in the development of an Arboretum program.

On another subject, we have heard from Mr. Tim Bullard, Public Affairs Manager from KOMO Radio and Television, informing us that during the calendar year 1972, KOMO Television aired a total of 186 announcements, and KOMO Radio a total of 62, on behalf of the Arboretum. This does not include the excellent panel discussion coverage of the symposium. Our sincere thanks to Kay Carson, who formerly handled our publicity, and to Mr. John Behnke and KOMO for providing this opportunity for us.



ROLE OF WASHINGTON PARK ARBORETUM IN PUBLIC AND COMMUNITY SERVICES

(Continued from page 14)

This would involve the negotiation of a new lease agreement with the City clearly establishing the University's role in the Arboretum. In order to insure the integrity of the arboretum portion and protect the basic plant collection, the University's experience has plainly demonstrated the necessity of providing adequate control measures. Public access would of course continue, but certain recreational pastimes would be discouraged. In the University's viewpoint, appropriate public uses are those which are not detractive to the operation of the Arboretum as an energetic public service, educational, and research enterprise.

CONCLUSION

Rhetoric and details aside, the basic decision which has to be made is whether or not all or some portion of Washington Park will remain an Arboretum. If an organization other than the University were to assume the operation of the Arboretum, it would inevitably become a much different type of institution and hence provide quite different services than those described in this paper. The University has other land areas available for its arboretum teaching and research functions, but its deep vested involvement in the Washington Park site and the important role that this site should play in public and community service has motivated the University to preserve this invaluable facility. In this endeavor the University and the Arboretum have gained much public support, particularly from those citizens who have been actively involved in Arboretum affairs over the years and recognize the benefits it has provided.

This is the Arboretum's story. The foregoing are the public service programs and opportunities which must be weighed in determining the future of the Washington Park Arboretum. This is too important a decision for it to be made by reasons other than complete awareness of the situation. If the decision is made to forfeit the Arboretum, it had best be made in full knowledge of the community loss which will result.

ORIGINAL AGREEMENT BETWEEN CITY OF SEATTLE AND UNIVERSITY OF WASHINGTON

Changing times require us periodically to re-evaluate and re-assess positions and policies. Such may be the case in regard to the Arboretum. Many Foundation members have requested an opportunity to read the original agreement between the City of Seattle and the University of Washington pertaining to the Arboretum. Unforeseen events have delayed publication of *The Long Road Travelled* by Dr. Henry Schmitz in which the agreement is printed. For that reason we are reproducing from Chapter Seven of that book the agreement as originally conceived and prepared by Mr. O. B. Thorgrimson in collaboration with representatives of the University. Mr. Thorgrimson had journeyed to Boston, Massachusetts and had researched the agreement between that city and Harvard University for Arnold Arboretum. This agreement is patterned after that one.

We would urge all to read Dr. Schmitz' entire account of the development of the University of Washington Arboretum. The book will be off the press shortly. Full knowledge and understanding of foregone events hopefully will help to form the basis for intelligent future decisions.

The agreement as approved unanimously by the Board of Park Commissioners at the December 6, 1934 meeting follows:

AGREEMENT RELATING TO ARBORETUM AND BOTANICAL GARDEN IN WASHINGTON PARK

This Agreement, made between the City of Seattle, a municipal corporation, organized under the laws of the State of Washington, herein designated First Part, and the Board of Regents of the University of Washington, herein designated Second Party, WITNESSETH:

WHEREAS first party is the owner of certain park propery situated within the territorial limits of the City of Seattle, known as Washington Park; and

WHEREAS the parties hereto wish to establish and maintain within said Washington Park an arboretum and botancial garden; and

WHEREAS, second party is willing to take charge of planning for and the establishment of such arboretum and botanical garden; Now, Therefore,

In order to establish and maintain such arboretum and botancial garden, and in consideration of their mutual agreements, as herein set forth, it is agreed by and between the parties hereto as follows:

1. First party hereby grants to second party the right to use all or any portion of said Washington Park as now established or as may be hereafter extended (as more specifically set forth in the map hereto attached, marked Exhibit "A"), for an arboretum and botanical garden, second party to designate in writing from time to time the exact areas which it desires to devote to such use.

2. First party shall, at its own expense as funds are available, construct and maintain all roads, driveways, walks, water systems, lighting facilities, and such other permanent improvements as may be necessary to make accessible such scientific, educational and recreational advantages as may be derived from the establishment and maintenance of such arboretum and botanical garden.

3. First party agrees to use such funds as it may have available for the establishment of said arboretum, and to cooperate with second party in the establishment and maintenance of said arboretum and botanical garden, and to that end to donate such seeds, plants, shrubs, trees, equipment and labor as may be available.

4. Second party will, as soon as practicable, have prepared plans for such arboretum and botanical garden and submit same to first party for the approval of its Board of Park Commissioners, and thereafter the development of said arboretum shall be substantially in accordance with such plans as originally prepared and so approved with such modifications as may be made therein with the approval of both parties:

5. Second Party shall, as soon as possible, establish such arboretum and botanical garden, including in such work, among other things, the following items:

(a) Procuring seeds and plants from all parts of the world that may be suitable for growth in this climate;

(b) Establish quarantine station for the introduction of plants, shrubs and trees from foreign countries;

(c) Carry on experiments in the cultivation and growth of all forms of plant life;

(d) Establish special collections, such as of native plants and trees, those illustration plant relations, alpine groups, and other like collections;

(e) Establish and maintain an herbarium;

(f) Provide plant material for use of classes in the public schools and University.

6. Second party shall, subject to the provisions of Section 3 of Article XIII of the City Charter, have full control of the area devoted to said arboretum and botanical garden; provided, however, that such area shall be made available to visits by the public generally under rules and regulations adopted by the first party by its Board of Park Commissioners.

7. Second party shall have the right at such time or times as funds may be available, to erect suitable buildings and greenhouses for the use of the arboretum and botanical garden, and shall have the control thereof subject to the provisions of the City Charter, Article XIII, Section 3.

8. First party shall police the entire park including the portions used for said arboretum and botanical garden, and shall keep in good repair the walks and driveways leading to and within the area used as such arboretum, all in the same manner and to the same extent as in the absence of this agreement.

9. It is understood that first party shall have at all times access to every part of said arboretum and botanical gardens, including the buildings, for general visitation and the carrying out of such supervision and policing as first party shall deam necessary.

10. An advisory committee to be known as the Arboretum and Botanical Garden Committee, consisting of at least seven members is hereby created, three to be appointed by the Mayor of Seattle, three by the President of the University of Washington, and the seventh member to be appointed by the Governor of the State of Washington. Each of said members shall serve for a term of seven years from the first day of January, next succeeding their appointment, and until their successors shall have been appointed and qualified. Provided, however, that the first board named shall serve for terms of one, two, three, four, five, six and seven years, respectively, the particular term for which each of said first board members shall serve to be determined by lot.

11. Said advisory committee shall assist the parties hereto in establishing and maintaining said arboretum and botanical garden, in securing funds for the establishment and maintenance of said arboretum, and plants and seeds for use therein, in interesting people in said project, and in acting as a liaison committee between the Arboretum and the various garden and other societies interested in such Arboretum.

12. This agreement shall remain in full force and effect so long as such arboretum and botanical garden shall be maintained.

IN WITNESS WHEREOF, the parties hereto have executed this agreement in duplicate this 6th day of December, 1934.

THE CITY OF SEATTLE
BY ITS BOARD OF PARK COMMISSIONERS

Harry Westfall
President

ATTEST: H. W. Carroll
Secretary

COPY - ah

(Signed copy
Dean Condon, Secy. of
Board of Regents)

cc - Asst. Comptroller

Book Reviews

FLOWERS OF THE WORLD. By Frances Perry. Illustrated by Leslie Greenwood. Foreword by The Lord Aberconway. The Hamlyn Publishing Group Ltd., London. Distributed by Crown Publishers Inc., N.Y. (1972). 320 pp., 828 color illustrations. $22.50

When I first picked up this book at the bookstore I soon realized this was something extra special and that I must have it in spite of the $20 or more I was going to have to part with. After looking through *Flowers of the World* more thoroughly at home, I have not changed my mind about the quality of the book; in fact my enjoyment has increased.

Recently many good books have been published and are available to the gardening public. Most of them, though are on some specialized subject, e.g. roses, shrubs, pruning etc., but, as Lord Aberconway, President of the Royal Horticultural Society, says in his Foreword, this is "the type that will have universal and lasting appeal" to everyone who enjoys and appreciates flowers. The plants described and illustrated are trees, shurbs, climbers, perennials and annuals from all over the world.

It is compiled by two of the foremost leaders in their respective fields. Frances Perry, who has traveled to many parts of the world, author of several books and well known in the United States as a lecturer, has written the text in a delightful style, which reads like a story book of flowers, relating historical and legendary stories, anecdotes and old medicinal remedies of many of the plants. Also a great deal of botanical and horticultural information and advice is given, in many cases from her own long experience of collecting and growing plants. Leslie Greenwood, who has received many awards for his paintings, likewise is widely traveled. Realizing the need to paint his flowers from live material, he sought out plants from gardens and greenhouses all over Great Britain and had many living specimens flown to him from Malaya, Australia and South Africa. The talented artist that he is and the wide knowledge he has of his plants, makes his paintings botanically accurate in detail and color.

Looking at the pictures alone brings pleasure and sheer enjoyment of the magnificent beauty of our floral world. Many old favorites will be ssen and others that had perhaps been forgotten will be recognized. The magnolias, lilies, orchids and many others are particularly true to life and beautiful. A great deal of careful study and work has gone into the production of *Flowers of the World.* It is published in collaboration with the Royal Horticultural Society. The format design is good. The text is clear and easy to read and the 828 illustrations uncluttered and well spaced.

As C. Brickell, taxonomist, points out in his interesting and instructive introduction, the thousands of flowers depicted in this book, while covering a wide range of tropical, subtropical and temperate plants and representing the major plant families conveniently arranged in alphabetical order, are only a mere fraction of the enormous number grown throughout the world. His paragraphs on the continual changing of botanical plant names are useful and help us to understand the why and wherefore for correct nomenclature, even if we are, at times, loth to give up a latin name we have used for years (*Alyssum saxatile* is now *Aurinia saxatilis*) in favor a new one decreed by the botanist.

Printed on the flyleaves of the book are good examples of leaf shapes and forms and of flower inflorescences and floral parts. These are clear and instructive. There is a glossary containing a useful collection of botanical terms and explanations. An excellent index with latin names and almost as many common names is also included. These will be a great help to those of use not so botanically minded. In many instances two or more common names are given, which may well be used in different parts of the world, such as the Dove Tree in America and the Pocket Handkerchief Tree in Britain for *Davidia involucrata,* and the Himalayan Honeysuckle, Partridge Berry, Flowering Nutmeg and Elisha's Tears (a corruption of the generic name for *Leycesteria formosa).*

When a good book comes along it becomes increasingly difficult to find fault within its pages and if I have any criticism it is with two illustrations. In *Pernettya mucronata* the berries are globose rather than round and sit tightly in clusters in the leaf axils towards the end of the shoots. They do not hang on pedicels as portrayed. The color of Clematis 'Nellie Moser' should be a light mauvish-pink, not blue.

Flowers of the World, I think one can safely say, is as correct in detail and up-to-date as a book can be in these days of continuing alterations in nomenclature and could well be used as a standard work for those plants mentioned. I recommend this book to all lovers of flowers, whether he or she be amateur or professional, as a delightful and useful addition to their library of garden books.

N. D. MARRETT
Superintendent of Grounds
Children's Orthopedic Hospital

The following lectures, sponsored by the Friends of the Arboretum, will be held at the Eames Theater, Seattle Center:

February 27	– 10:00 A.M. –	Alpines, Mrs. Rodney Allen
March 13	– 10:00 A.M. –	Ferns, Mrs. Harry Olsen
March 27	– 10:00 A.M. –	Trees and Shrubs, Mrs. J. Wendell Trosper, Mrs. Hugh Baird
April 12	– 8:00 P.M. –	More About The Botanist in a Grocery Store Dr. Richard Howard, Arnold Arboretum
April 27	– 8:00 P.M. –	Japanese Plants for our Northwest Gardens Dr. Walter D. Hodge, National Science Foundation
May 10	– 10:00 A.M. –	Practical Gardening for You, Open Workshop Moderator, Mai K. Arbergast, Landscape Architect, Berkeley, Ca.

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